THURSDAY, SEPTEMBER 19, 1878

THE LINKS OF THE ANIMAL WORLD

Les Enchaînements du Monde Animal dans les Temps Géologiques, Mammifères, Tertiares. Par Albert Gaudry. 8vo. (Paris: F. Savy, 1878.)

UNDER this poetic title Prof. Gaudry has added one more to his valuable works on the fossil mammalia of the Tertiary Period. Some sixteen years ago he carried on the explorations on the classic ground of Pikermi, which proved that the plains of Marathon were haunted by antelopes, gazelles, giraffes, and hipparions, in the upper miocene age, while the forests then overshadowing rocky Attica sheltered the mastodon and rhinoceros, and yielded food to innumerable monkeys (Mesopithecus) allied to the Barbary ape. During the last five years he has been painting a like picture of the upper miocene mammalia of Mont Léberon, in which, as in Pikermi, the remains of the animals are preserved in an abundance and a perfection somewhat like those discovered in the Western States, by Prof. Marsh. The two elaborate quartos on these discoveries are now followed by an elegant octavo full of woodcuts, treating of the links that bind together some of the more important groups of tertiary and living mammalia. In it the author deals with the European mammalia without treating exhaustively the accumulation of facts brought to light by Marsh, Hayden, Leidy, and others, in the American eocenes and miocenes. Nor are these as yet published in sufficient detail to allow of their being worked into the book before us. The impression made upon my mind by the vast stores of remains in the museum at Yale is one of profound melancholy; for so numerous and varied are the mammalia that many years must elapse before they can be brought into complete relation with those of Europe. Up to the present time the fragmentary notices which have appeared bear the same relation to the systematic treatment to be expected from Prof. Marsh, that isolated *tesseræ* bear to the whole design of a mosaic. Prof. Gaudry, therefore, has acted well in confining his work mainly to the Tertiary mammalia of Europe.

Our author approaches his subject from the point of view offered by evolution, by taking some of the more salient characters of a group, and tracing their "descent with modification," in passing from older to newer stages of the geological record. The fishes passed through the principal phases of their evolution in the Primary, the reptiles manifested their most extraordinary modifications in the Secondary age, and at its close had settled down into that equilibrium which they now present, while the mammalia were being unfolded, form after form—"en pleine évolution"—in the Tertiary Period. In the opening chapter the relation of the marsupials to the placental mammals is discussed, and our author concludes, from the results of embryology, that the former must have preceded the latter, and that the imperfect and helpless condition of the young, nourished in a marsupium, or taking refuge on the back of the mother, would be a serious obstacle to rapid increase, since the young would be likely to be drowned in the passage of rivers or arms of the sea in migration in search of food. This may have been one of the causes of their being supplanted by the placental mammals at the beginning of the Tertiary Period, as they would be heavily weighted in the struggle for life by this condition. The elimination of the marsupial herbivora from the Tertiary fauna of Europe and America might have been produced by the migration rendered necessary by the great geographical and climatal changes at the close of the cretaceous age. It is a significant fact that the only living mammalian genus found in the eocene age is the tree-haunting Didelphys, which took refuge probably in the forests, and held its place in Europe as late as the lower miocene age, and which still holds its own in the warmer parts of America as the sole representative of a Secondary marsupial fauna once in possession of the European and American continents. There are, however, traces of a marsupial fauna other than those offered by Didelphys, to be seen in certain *intermediate forms.* The Hyænodon of the eocene and lower and middle miocene, and the eocene Pterodon, were carnivores combining the dental formula of four true molars (three of which are carnassials), and three premolars of the *Thylacinus,* with the characters of an ordinary placental carnivore. The dentition of the lower eocene Palæonictis is remarkably like that of the Tasmanian Dasyure, and the lower miocene Proviverra unites a marsupial dentition and brain with the ordinary viverrine attributes. These marsupial characteristics can only be accounted for on the hypothesis that they have been handed down from a marsupial ancestry, and they render the conclusion highly probable, that all the placental are descended from the implacental carnivores.

Prof. Gaudry points out that the rhinoceros and the palæothere are probably descended from common ancestors, and shows the gradual modification of skull, and evolution of horns in the former animal. In the middle miocene a hornless rhinoceros (Aceratherium) appears, and is accompanied in the upper miocenes of Eppelsheim by a small horned species, of which it is probably the female. As we pass upwards to the pliocene the horn becomes more highly developed, and the nasal bones more strongly built, until we arrive at a maximum in the pleistocene *Rhinoceros tichorhinus.* We believe that the horn was originally a male character transferred ultimately to the female in the way pointed out by Mr. Darwin.

In like manner, also, our author traces the evolution of horns and antlers in the ruminants. The earliest representative of the order, if it be a representative, is the hornless Xiphodon of the upper eocenes. Horns come in in the middle miocene, and in the upper attain a considerable development, as in the antelopes. We may add that, in Europe, the bovine development of horns arrived at its maximum in the gigantic bisons and uri of the pleistocene, while in the pliocene of Italy there was a bos without any horns—a fact which renders it probable that the polled cattle produced by domestication is merely a case of a reversion to an ancestral type fostered by the care of man. None of the lower miocene deer possessed antlers. In the middle miocene they are bifurcated, as in the Muntjac; in the upper they are still small, and with three or more types; in the pliocene they pass through the stages presented by the

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Axis and Rusa, ultimately culminating in the wonderfully complex antlers of *Cervus Sedgwickii* of the forest bed, and *C. dicranios* of the Val d'Arno, and in the gigantic antlers of the pleistocene, and pre-historic Irish elk. It must, however, be pointed out that the *Cervus Matheronis* of the upper miocene, identified by Prof. Gaudry with the Axis, has no relation with that animal, as may be seen by the examination of the most perfect antlers yet discovered of the former animal, in the British Museum. A more rudimentary form of antler (*Procervulus*, Gaudry) even than the Muntjac has been discovered in the middle miocene strata of Thenay, without a burr, which was, like ordinary horns, persistent through the life of the animal.

We have merely touched upon some of the questions raised in this work, which occupies most important ground in the evolution controversy, and may be looked upon as one of the first fruits of the principles laid down by Mr. Darwin in the "Origin of Species."

W. BOYD DAWKINS

AMERICAN GEOLOGICAL SURVEYS

United States Geological Exploration of the Fortieth Parallel. By Clarence King, Geologist in Charge. Vol. II. *Descriptive Geology*, 1877. Vol. IV. *Ornithology and Palæontology*, 1877. (Washington: Government Printing Office, 1877.)

THE important survey of a portion of the north-western states of America, which was commenced by Clarence King and his able assistants in 1867, has now, after ten years of arduous labour, been brought to a close. In the original scheme drawn up for the publication of the results of this survey it was proposed that the observations of the surveyors should be published in five volumes, devoted to the following subjects:—

I. Systematic Geology.
II. Descriptive Geology
III. Mining Industry.
IV. Zoology and Palæontology.
V. Botany.

The third of these volumes was prepared and issued soon after the commencement of the survey. It abounds with valuable details concerning the rich ore deposits of the north-west and the methods by which they can best be worked. It is difficult to know which to admire most—the accuracy and beauty of illustration of this volume or the characteristic energy and promptitude with which it was produced in order to meet a pressing want.

In 1876 a supplementary volume numbered VI., not contemplated in the original scheme, was published; it deals with the subject of Microscopic Petrography, and is from the pen of Prof. Zirkel, of Leipzig. As this work has already been noticed in the pages of NATURE, we need do no more on the present occasion than refer to the circumstances under which it was published.

Two other volumes, those numbered II. and IV. are now before us, and amply sustain the high reputation which Mr. Clarence King and his indefatigable fellow-workers have acquired for energy and zeal in the prosecution of their important task, no less than for great geological knowledge and literary ability.

The volume on Descriptive Geology consists of a series of chapters giving full and accurate accounts of the geological features of the Rocky Mountains, the Green River Basin, the Utah Basin, the Nevada Plateau, and the Nevada Basin respectively, the descriptions being from the pens of Arnold Hague and S. F. Emmons. The rocks exposed in this vast area include representatives of the whole series of geological formations from the Archæan to the Post-pliocene, together with many plutonic and volcanic masses belonging to various geological periods. The descriptions are of the most minute and careful character, and are interspersed with valuable analyses of the rocks described.

One of the most useful features of this volume is the series of twenty-six lithographic plates illustrating the grand and peculiar scenery of the district. These are admirable copies of photographs taken upon the spot, and they are probably, without exception, the most successful attempts to illustrate scenery in this manner that have ever been made. We would especially instance Plates V. and VI., illustrating the Tertiary bluffs near Green River City, Wyoming, and Plate XIV., showing the characters of the Wahsatch Limestone Cliffs, Provo Cañon, Wahsatch Range, as presenting the characteristic features of rock-masses in a manner which cannot fail to be appreciated by every geologist who has had opportunities for extensive observation in the field. Other plates, such as X., representing the Agassiz Ampitheatre in the Uinta Mountains, and XIX., in which a ridge of Archæan quartzite in the Humboldt Range is depicted, are wonderfully striking reproductions of the remarkable scenery of the district. In a series of plates illustrating the saline springs, we have the peculiar features of the great plains also presented to us in a very vivid manner.

Volume IV. consists of three parts. In the first of these a series of fossils from all the formations, from the Silurian to the Tertiary inclusive, are described by the late F. B. Meek. This part is illustrated by seventeen lithographic plates of great excellence. The second part is by James Hall and R. P. Whitfield, and describes certain new forms, from the Primordial to the Jurassic; it is illustrated by seven plates.

The third part of the volume is devoted to the description of the habits of the various species of birds met with during the several expeditions. It is from the pen of Mr. Robert Ridgway, the zoologist attached to the staff.

The United States Government is to be congratulated on having been able to secure such valuable illustrations of the natural history of their extensive and interesting territories as are contained in the splendid volumes before us, and the value of these contributions to science is greatly enhanced by the liberality with which they have been distributed among scientific workers and public libraries in every part of Europe. We shall look forward with much interest for the appearance of the other volumes of the series.

J. W. JUDD

OUR BOOK SHELF

Tent Work in Palestine. A Record of Discovery and Adventure. By Claude Regnier Conder, R.E., Officer in Command of the Survey Expedition. Two vols. (London: Bentley and Son, 1878.)

THIS is the first substantial result of the survey of Palestine, which has been going on for the last few years. It

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